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Lactic Acidosis Secondary to Severe Anemia in a Patient With Paroxysmal Nocturnal Hemoglobinuria

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A patient with paroxysmal nocturnal hemoglobinuria developed lactic acidosis associated with severe anemia. The lactic acidosis corrected after blood transfusion. In the absence of shock, sepsis, or other identifiable causes of lactic acidosis, the severe anemia (hemoglobin 1.2 g/dl) appeared to be the primary etiologic factor. Am. J. Hematol. 55:110–111, 1997. © 1997 Wiley-Liss, Inc.

Key words: lactic acidosis; anemia; paroxysmal nocturnal hemoglobinuria

INTRODUCTION

Many cases of lactic acidosis are secondary to tissue hypoxia. Severe anemia and carbon monoxide poisoning can, like tissue hypoperfusion due to shock, decrease oxygen delivery to the tissues [1]. Severe hypoxemia has been reported in animal studies to cause lactic acidosis by decreasing oxygen delivery to tissues [2] and may contribute to lactic acidosis in humans as well [3,4]. We found only three reports where severe anemia was causally related to lactic acidosis [5–7], and we report on a fourth case in a patient with paroxysmal nocturnal hemoglobinuria (PNH).

CASE REPORT

A 21-year-old man was found lying on the floor at home. Six months previously he had presented with weakness and severe anemia (hemoglobin 1.5 g/dl, hematocrit 6%) without metabolic acidosis, and was diagnosed with PNH. At that time he received red blood cells (RBC) with improvement. On the current admission he complained of profound weakness and abdominal pain. Physical examination revealed an icteric man who was tachypnic and afebrile, and who had a blood pressure of 128/70 mm Hg. He had a systolic ejection murmur at the left sternal border and mild abdominal tenderness. Arterial blood gas showed a pH of 6.96. The anion gap was 21 meq/l, lactic acid 28.1 mmol/l, hemoglobin 1.2 g/dl, and hematocrit 3.0% (repeat values: hemoglobin 1.4 g/dl and hematocrit 2.9%); white blood cells (WBC) were 2,620/μl, reticulocytes 6.5%, and platelets 30,000/μl. Blood urea nitrogen (BUN) and creatinine were normal. Pertinent data on presentation (day 1) and during his hospital course are shown in Table I. Chest X-ray showed moderate cardiomegaly without any infiltrates. His urine was dark brown and positive for protein, blood, and 1–3 WBC per high-power field. The patient was transfused with 1 unit of RBC and his hemoglobin improved to 2.2 g/dl, hematocrit to 5.7%, and blood pH to 7.30, within 12 hr after admission. His lactic acid decreased to 3.5 mmol/l within 24 hr after the first transfusion. Over 24 hr after admission he developed a temperature of 102°F. He received 2 more units of RBC and the hemoglobin and hematocrit improved to 5.1 g/l and 13.3%, respectively, and his blood pH to 7.41. Multiple blood cultures were negative.

DISCUSSION

We are aware of 3 cases of lactic acidosis causally associated with severe anemia [5–7]. The first case was thought to be secondary to anemia in a patient with pernicious anemia with a hemoglobin of 4.8 g/dl, lactic acid of 5.2 mmol/l, and a blood pH of 7.25 [5]. The second was a patient with iron deficiency anemia and a hemoglobin of 1.5 g/dl, hematocrit 7%, lactate 19.6 mmol/l,

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TABLE I. Pertinent Data From Hospital Course

	Expected value	Day 1	Day 2[a]	Day 3[b]	Day 4	Day 5
Hemoglobin	13–16 g/dl	1.2	2.4	5.1	5.3	5.7
Hematocrit	42–50%	3.0	6.3	13.3	14.7	17.0
Lactic acid	0.5–1.8 mmol/l	28.1	3.5			
Blood pH	7.35–7.45	6.96	7.41	7.40	7.40	
pCO_2	35–45 mm Hg	10.9	29.9		48.8	
Bicarbonate	24–28 mmol/l	2.4	8.9		29.8	
Aspartate aminotransferase (SGOT)	8–33 U/l	1,349.0	3,446.0	833.0	189.0	70.0
Alanine aminotransferase(SGPT)	3–36 U/l	420.0	1,139.0	969.0	638.0	355.0
Lactate dehydrogenase	80–250 U/l	4,899.0	11,342.0	2,698.0	1,760.0	1,316.0
Prothrombin time	11.0–12.8 sec	27.3	18.1		13.9	
Partial thromboplastin time	20.5–30.4 sec	58.1	28.1		25.5	
Fibrinogen	197–497 mg/dl	101.0	78.0	114.0		248.0
Glucose	70–110 mg/dl	169.0	151.0	114.0	75.0	80.0
Temperature	T_{max} (°F)	98.2	102.0	100.8	99.5	98.2
Blood pressure	mm Hg	124/70	127/75	120/68	120/80	122/76

[a]Data after transfusion of 1 unit of RBC.
[b]Data after transfusion of 2 units of RBC.

and blood pH 6.8 [6]. The patient presented with a blood pressure of 70/0 mm Hg, a high WBC count, and a low-grade fever. The lactic acidosis was from hypovolemia with severe anemia. The third case was another patient with iron deficiency anemia [7]. The hematocrit was 5%, lactate 17.5 mmol/l, blood pH 7.25, blood pressure 90/60 mm Hg, and WBC 12,000/μl. Temperature, chest X-ray, and blood culture results were not noted. The patient had laboratory evidence of liver damage, which improved after blood transfusion.

Several syndromes of mitochondrial DNA abnormalities cause both anemia and lactic acidosis [8,9]. These syndromes involve sideroblastic anemia (hemoglobin levels 5–8 g/dl) and multisystem dysfunction, and can be fatal in early childhood [8], or they may appear later in life with moderate anemia and myopathies [9]. The mechanisms causing lactic acidosis in these patients may be similar to the postulated hypoxemic mechanisms in our patient.

Our patient was first seen in a state of severe lactic acidosis in the absence of hypotension, fever, or infection. His hemoglobin level of 1.2 g/l and hematocrit of 3.0% are the lowest values reported among the published cases of severe anemia associated with lactic acidosis. Despite being normotensive he presented with a picture of ''shock liver,'' evidently caused by hypoxic damage to the hepatocytes, which improved after RBC transfusions (Table I). A report of lactic acidosis from carboxyhemoglobinemia [10] suggests that lactic acidosis can also develop from decreased oxygen-carrying capacity of hemoglobin. Our case provides evidence that severe anemia can cause lactic acidosis.

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